after that the suction gas is much the cheaper. At 200 b.h.p. the suction gas is nearly one-third the cheaper.

There are some very interesting folding plates showing the pipe-work necessary for various designs of gas-engines; the various kinds of pipes—gas, water, and exhaust—are shown in different colours, and thus the matter is made very clear.

Nearly ninety pages of the book are devoted to descriptions of American gas-engines, made by Westinghouse, Allis Chalmers, the Snow Engine, and many others. Many of the drawings are dimensioned, and the results of numerous tests are given.

In part iv. various fuels available for producing gas are described, and there is an extensive table on American coals, giving for each full analysis and the calorific value per pound; there is also information with reference to blast-furnace gases and coke-oven gas, also with regard to various oils, alcohol, &c. There is an important table giving the explosive range of various gases. The remainder of the book consists of the theory of the gas-engine and producers, and in the appendix the fullest particulars are given of the methods of testing gas-engines prescribed by the American Society of Mechanical Engineers and by the German Society of Engineers. This information is of great importance, especially as at the present moment there is nothing of the kind issued by any society of British engineers in connection with gas- or internal-combustion engines.

STRUCTURE AND DISTRIBUTION OF ORE DEPOSITS.

Lehre von den Erzlagerstätten. By Dr. R. Beck. Dritte Auflage. Band i., pp. xii+540+1 map; Band ii., pp. x+542. (Berlin: Gebrüder Borntraeger, 1909.) Price, two vols., 32 marks.

PROF. BECK'S "Lehre von den Erzlagerstätten" is one of those works which disarm criticism. The predominant feeling in the mind of the geologist when using it must be of gratitude to its author for this comprehensive and up-to-date account of the structure and distribution of ore deposits. The previous edition was published in 1903, and an American version, translated and edited by Weed, was issued in 1905. The new edition has been so much enlarged that it now appears as two volumes, each almost equal in size to the original.

The book follows the same general lines as the previous editions, but there are many important changes which indicate the trend of current opinion as to ore classification. Prof. Beck divides ores into two primary divisions, the epigenetic and syngenetic, those formed respectively later and simultaneous with the rocks in which they occur. These divisions are, however, practically abandoned in the work. The author divides ores into eight groups, in which the first, seventh, and eighth in order of treatment are mostly syngenetic; the intermediate groups are epigenetic, but include some ores which are admittedly syngenetic. The term syngenetic, though it appears in the introduction, is not much used, but epigenetic recurs frequently. That term is not altogether satisfactory, as most of the epigenetic ores are subterranean, and some of them are very deep seated in origin. Hence epigenetic ores are not epigene, but hypogene, to use two old and well-established geological terms.

The ores first treated are those attributed to direct segregation in molten rocks. They are the truly igneous ores. Prof. Beck recognises fourteen types, of which all but four were included in the previous edition. The only new type of oxide ores amongst these is that of magnetite in granite, described by Vogt, from the Lofoten Islands. Prof. Beck, however, in a note added to the proofs, remarks that Sjögren's recent paper confirms his own opinion that these granitic ores are due to contact metamorphism, and not segregation. The whole chapter on magmatic segregation shows that less importance is attached now than formerly to this process of ore formation. The author includes the nickel ores of Sudbury in this chapter, but recognises that they are mainly due to secondary processes. He also quotes Loewinsen Lessing's interesting work on the famous iron ores of the Urals, which are thus shown to be contact deposits and not segregations, as has been usually maintained; and as Prof. Beck points out, the great Lapland ores, which have also been claimed as igneous segregations, must be regarded as of the same origin as those of the Urals.

The group of ores which came second in the previous edition, included those deposited by direct sedimentation and precipitation. These aqueous ores were placed next after the igneous, because both groups are syngenetic. Description of the sedimentary ores is now postponed till near the end of the book, and the ores due to contact metamorphism take their place. This significant change is a great improvement, as many of the ores now assigned to igneous segregation will probably be found to be contact deposits. The bulk of the work is occupied with a description of the epigenetic ores, which include ordinary mineral veins and certain ores in stratified rocks, due to the same process as ore veins. The author includes here the banket of the Transvaal. He gives an excellent judicial summary of the arguments in favour of the rival theories as to the origin of that ore without here expressing any very definite preference. He obviously still favours the infiltration theory which he has elsewhere supported. In reply to the suggestion that much of the pyrites in the banket is altered "black sand," he asks what has become of the ilmenite that is usually associated with magnetite in such deposits. There is, however, plenty of titanic oxide in the banket which has probably been derived from decomposed ilmenite. Little stress is laid on the old arguments in support of the infiltration theory, and according to Prof. Beck the weightiest argument in its favour is the dependence of the gold contents of the banket on its dip. This may be questioned as a matter of fact, and it is at any rate an indefinite and unconvincing argument. The author includes the West African banket as also epigenetic, though he accepts its gold as alluvial in origin. It is not surprising to find this ore described immediately

after that of the Rand, for those who know both deposits regard them as of the same origin, though the iron ores of the West African banket still mainly occur as magnetite. It seems difficult to regard the West African banket as a modified placer, and the South African as an ore due to infiltration.

The feature in Prof. Beck's arrangement of ores which seems most improbable is his reference of so many metalliferous sandstones and conglomerates to the epigenetic group. He includes there, for example, the Katanga quartzite, which contains small nuggets of gold and platinum. In fact, the only pre-Cainozoic alluvial gold deposits which are included in the chapter on detrital ores are those of the Cambrian of the Black Hills of Dakota, a few occurrences of no economic value in the Carboniferous rocks of Australia, Nova Scotia, and France, and in the Mesozoic of California, New Zealand, and Saxony. Alluvial gold must have been deposited in pre-Cainozoic times, but whenever ancient gravels are of much economic value their gold is attributed to infiltration. While in some cases Prof. Beck may be disposed to underrate the extent of ancient alluvial ores, he includes the tin deposits of Mt. Bischoff in Tasmania as alluvial, having apparently overlooked a short note upon that mine, explaining its tin-bearing sands as decomposed gossan in which a pseudo-stratification has been produced by the settling of the decaying rock.

Prof. Beck's work shows remarkably thorough acquaintance with recent literature on economic geology, and his statement of rival hypotheses is always given with scrupulous fairness. This greatly enlarged edition will become even more indispensable as a work of reference than its predecessors, and is worthy of the high traditions of the Freiburg Mining School.

J. W. G.

THE SUGAR-CANE AND ITS PRODUCTS.

The Manufacture of Cane Sugar. By Llewellyn Jones and F. I. Scard. Pp. xix+454. (London: Edward Stanford, 1909.) Price 12*s.* 6*d.* net.

A NOTEWORTHY feature in tropical agriculture is the new lease of life taken recently by the cane-sugar industry. A few years ago it appeared not improbable, to say the least, that the sugar-cane was doomed to be forced into a position permanently inferior to that of the beet as a source of the world's supply of sugar. Originally possessed of a practical monopoly, the cane had lost so much ground that in the opening years of this century the beet supplied about two-thirds of the sugar which came into the world's markets. It is true that a great deal of cane-sugar is consumed in countries where it is produced and escapes record; so far as the world's commerce was concerned beet was the chief contributor. Within, however, the last five years, the output of cane-sugar has markedly increased, whilst that of beet has slightly diminished, and a little more than one-half of the sugar of commerce is now derived from the sugar-cane.

This period of activity in the industry has been marked by the issue of various books. One of the most useful is that now under review. The authors have wide practical experience of sugar-making, as engineer and chemist respectively; with the aid of numerous illustrations they present the results of their experience in an exceedingly simple manner.

A marked feature of the book is the explanation of practical matters in clear, non-technical language, and a reader with no special engineering knowledge and no experience of sugar-making should easily understand and be able to follow the whole chain of processes by which the ripe sugar-cane is converted into sugar and the various by-products.

No pretence is made to deal with cultivation. There is in chapter i. an illustrated account of the structure of the cane (the references on pp. 3 and 4 to the figures are not accurate), and notes on the chief varieties, diseases, chemical composition, &c.; but the subject-matter proper of the book opens with crushing, in the next chapter. Whilst the novice will read this easily, the mature planter will find much worthy of consideration, as, for example, in the excellent presentment of the *pros* and *cons* of improved methods of extraction. In dealing with the boiling or concentration, the evolution of the modern vacuum pan, capable of yielding 40 tons of sugar at a single operation, is traced from the simple open pan still in use in many parts of the world. Equally here, whether dealing with the simplest or the most complicated processes, the authors have contrived to preserve a conspicuously clear and direct style.

The volume is one which should be of great value to non-technical readers who wish to obtain information regarding one of the best-organised and most scientific of the great industries of the tropics. The practical sugar-maker will appreciate the exposition of the theory underlying various processes, the clear description of methods, and also doubtless derive assistance from the useful practical hints with which the book abounds.

W. G. F.

THE PSYCHOLOGY OF THE WILL.

Ueber den Willensakt und das Temperament: eine experimentelle Untersuchung. By Prof. Narziss Ach. Pp. xii+324. (Leipzig: Quelle and Meyer, 1910.) Price 6.50 marks.

TO the layman an act of volition is one of those obvious things, such as gravity or growth, which present no difficulty and suggest no problem. Their mechanism is so smooth in its working that the mind never dreams of the presence of a mystery. Add to which the fact that it is impossible to go through the process of willing and at the same time to contemplate and observe the process. Yet at least one difficulty has been noted by the crudest philosophy for ages past—the power of choice, the so-called freedom of the will. This, however, as Prof. Ach observes, is a function not of the will but of reason. He also well insists that the judgment "I can do that which I will," has two distinct meanings, which have often been confused. The one meaning is positive, "I have the capacity to carry out what I will"; "can" being equivalent to *posse, pouvoir, vermögen.* The other is negative, "It is my wish to do what I will." Psychologists are only too well aware that "In